09/856609
JC19 Rec'd PCT/PTO 23 MAY 2001

Practitioner's Docket No. BE7344PCT(US)

CHAPTER II

Preliminary Classification:
Proposed Class:
Subclass:

TRANSMITTAL LETTER
TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/EP99/09194	26 November 1999 (26.11.99)	27 November 1998 (27.11.98)
International Application Number	**International Filing Date**	**International Earliest Priority Date**

TITLE OF INVENTION: IMPROVEMENTS IN OR RELATING TO REFRACTORY PRODUCTS

APPLICANT(S): DIDIER-WERKE AG; LEE, Stephen John

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231
ATTENTION: EO/US

CERTIFICATION UNDER 37 C.F.R. SECTION 1.10*
(Express Mail label number is ***mandatory.)***
(Express Mail certification is optional.)

I hereby certify that this paper, along with any document referred to, is being deposited with the United States Postal Service on this date, **May 23, 2001**, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number **ET180712291US**, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Elaine Zakrzewski
(type or print name of person mailing paper)

Elaine Zakrzewski
Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. Section 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

WARNING:* *Each paper or fee filed by "Express Mail"* ***must* *have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. Section 1.10(b).*
"Since the filing of correspondence under [Section] 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will ***not*** *be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

1. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. Section 371:

a. This express request to immediately begin national examination procedures (35 U.S.C. Section 371(f)).

b. The U.S. National Fee (35 U.S.C. Section 371(c)(1)) and other fees (37 C.F.R. Section 1.492) as indicated below:

2. Fees

CLAIMS FEE*	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALC-ULATIONS
	TOTAL CLAIMS	9 -20 =	0	x $18.00 =	$0.00
	INDEPEN-DENT CLAIMS	1 - 3 =	0	x $80.00 =	$0.00
	MULTIPLE DEPENDENT CLAIM(S) (if applicable) + $270.00				$270.00
BASIC FEE	U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in Section 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in Section 1.445(a)(2) to the U.S. PTO: where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 C.F.R. Section 1.492(a)(5)) $860.00				$860.00
	Total of above Calculations				= $1,130.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed. (note 37 CFR Sections 1.9, 1.27, 1.28)				- $0.00
	Subtotal				$1,130.00
	Total National Fee				$1,130.00
	Fee for recording the enclosed assignment document $40.00 (37 C.F.R. Section 1.21(h)). See attached "ASSIGNMENT COVER SHEET".				$0.00
TOTAL	Total Fees enclosed				$1,130.00

A check in the amount of $1,130.00 to cover the above fees is enclosed.

3. A copy of the International application as filed (35 U.S.C. Section 371(c)(2)) is transmitted herewith (see International Publication No. WO 00/32337).

4. A translation of the International application into the English language (35 U.S.C. Section 371(c)(2)) is not required as the application was filed in English.

5. Amendments to the claims of the International application under PCT Article 34 are transmitted herewith.

6. A translation of the amendments to the claims under PCT Article 34 is not required as the amendments were made in the English language.

7. A copy of the international examination report (PCT/IPEA/409) is transmitted herewith.

8. A copy of the Written Opinion is transmitted herewith.

9. A copy of the Response to the Written Opinion is transmitted herewith.

10. A copy of the Amended Sheets (2 pages) listing amended claims 1-9.

11. An oath or declaration of the inventor (35 U.S.C. Section 371(c)(4)) complying with 35 U.S.C. Section 115 will follow.

12. An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a) is transmitted herewith.

13. An Information Disclosure Statement under 37 C.F.R. Sections 1.97 and 1.98 is transmitted herewith. Also transmitted herewith are Form PTO-1449 and copies of citations listed.

14. Additional documents:

a. Copy of request (PCT/RO/101)

b. International Publication No. WO00/32337 (Specification, claims and drawing)

15. The above items are being transmitted before 30 months from any claimed priority date.

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AUTHORIZATION TO CHARGE ADDITIONAL FEES

The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No.: 50-0537.

37 C.F.R. Section 1.492(a)(1), (2), (3), and (4) (filing fees)
37 C.F.R. Section 1.492(b), (c), and (d) (presentation of extra claims)
37 C.F.R. Section 1.17 (application processing fees)

Date: 23 MAY 2001

Mark Kusner
Signature of Practitioner

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09856609.081501

PCT/EP99/09194

CLAIMS

1. A refractory device for use in the teeming of molten metal, comprising a ceramic pouring tube element 10, supported in a metallic can 11, in which a ceramic support element 12 is encapsulated and a shock-absorbing interface zone 13 between said metallic can 11 and the ceramic pouring tube element 10, wherein there is provided a material the thermal properties of which are such that it is substantially solid at ambient temperatures but becomes deformable at elevated temperatures experienced during metal teeming.

2. A refractory device according to claim 1, wherein the material selected for use in the interface zone 13 is structurally solid at temperatures up to about 700°C and becomes deformable without any appreciable chemical degradation at temperatures above about 700 °C.

3. A refractory device according to claim 1 or 2, wherein the material providing the interface zone 13 comprises a pyroplastic ceramic material.

4. A refractory device according to claim 3, wherein the interface zone 13 comprises a ceramic material such as a paste or bonding agent or additional structural ceramic element.

5. A refractory device according to claim 3, wherein the pyroplastic material is a frittable composition applied over at least one of the co-operating assembly surfaces of the pouring tube element and the support element.

6. A refractory device according to any one of the preceding claims, wherein the ceramic support element 12 is fully encapsulated within the metallic can 11, and fits with and around the upper part of the pouring tube element 10 by virtue

AMENDED SHEET

EP-A-0 346 378 describes the development of a monotube configuration and compares that to a two part plate and tube assembly generally known and used within an exchange nozzle casting mechanism as described above. The pouring tube element combines a body of high thermal shock resistance and corrosion resistance with a sliding plate surface able to form a tight closure against the stationary components of the mechanism. The sliding plate surface also incorporates a hard edge to permit cutting through any metal skin which may form during the casting operation and which may restrict free movement of the exchange monotube during the replacement procedure.

An important advantage of the monotube configuration over the original fired plate and tube or cast plate and tube assemblies was the elimination of generally horizontal joints connecting the internal casting bore of the tube with the external atmosphere, thereby eliminating the risk of air ingress or metal leakage across this joint region.

As casting conditions have become more severe and service life requirements of refractory products increased, new demands have been placed on the monotube elements of an exchange of an exchange nozzle casting mechanism.

In meeting these demands alternative compositions for the pouring tube element have been developed making it possible to maintain the plate surface and cutting edge configuration whilst providing improved corrosion and erosion resistance. These improved materials for the pouring tube element of a monotube do however exhibit different thermo-mechanical properties from the original materials as shown in the following table:

MONOTUBE POURING TUBE ELEMENT COMPOSITIONS

CONVENTIONAL		HIGH CORROSION RESISTANCE
40	Al_2O_3%	64
18	SiO_2%	6
28	C%	24
8	ZrO_2%	6

4	SiC%	-
2.38	Bulk density g/ml	2.6
0.35	Thermal Expansion% 0-1000	0.52

In operation, it has been shown that whilst the overall criteria for performance improvement has been met there is an increased risk that thermo mechanical stresses arising at the outset of casting can cause an external micro-crack fracture at the section change between the head and body portions of the pouring tube. In many instances, this micro-crack feature is contained by the inherent integrity of the ceramic body. This results in no operational problem, but in extreme cases it is possible for the external micro-crack fracture to propagate across the ceramic wall of the tube to the inner bore. This allows either air ingress or metal leakage, both of which cause termination of the cast and possible damage to the exchange nozzle casting mechanism.

Studies of the behaviour of the conventional metallic can and pouring tube element showed that the metallic can, essential to provide the accurate geometry required for a precise fit into the exchange nozzle casting mechanism could also act to transfer heat from the pouring element into the cooled mechanical mechanism, thereby increasing the thermal gradient at this critical point. Additionally at the temperatures experienced during preheat prior to cast start up the lower region of the can would reach a temperature of approx 900°C at which the relatively mild steel from which it is formed loses its rigidity and ceases to provide the desirable structural support below the section change.

A further development of the monotube concept is shown in US 5 866 022 which describes the assembly of a co-pressed, mixed material tube element, as described by EP A 0 346 378 adapted to the desired operational configuration by use of castable materials directly infilling the void between the outer surface of the tube and the inner surface of the metallic support element. This is shown in Figure 4.

Whilst this design concept has shown benefits in terms of reduced incidence of microcrack formation causing in service failures, examination of

used pieces shows that a risk remains that a crack will propagate from the angle between the tube and plate sections of the co-pressed tube element, as shown in Fig 5. This behaviour is not of such severe consequence as the failures of the type illustrated in Fig 3 as it does not necessarily result in molten steel leakage. It is however desirable to eliminate this risk.

Extensive computer simulation of the thermo-mechanical stresses arising during preheat and start up of casting has identified the possibility of minimising the stresses leading to such micro crack formation and propagation, by minimising the thermal gradient across the tubular pouring element, providing continuing support below any section change and optimisation of the external geometry of the tubular pouring element.

An object of this invention is to obviate or mitigate the risks of exaggerated thermo mechanical stresses in the new generation of pouring tube elements, and this is found to be achievable by revising both the design of the pouring tube element and the manner in which it is contained within the can. It will be recalled that location of the refractory within the support can requires care to provide the correct geometrical configuration to allow effective operation of the exchange tube mechanism and maintain the principle of no direct horizontal connection from the bore to the exterior other than the machined sliding surface.

According to one aspect of the present invention there is provided a refractory device for use in the teeming of molten metal comprising a ceramic body having a ceramic pouring tube element and a ceramic support element, said support element being adapted to be received within a metallic can, and there is provided between said elements a shock-absorbing interface zone wherein there is provided a material the thermal properties of which are such that it is substantially solid at ambient temperatures but becomes deformable at the elevated temperatures experienced during metal teeming.

Thus, the interface zone provides continuity of mechanical support to the body portion when in the substantially solid (cool ambient temperature) condition to ensure structural integrity of the assembled refractory device, but deforms sufficiently to provide a buffer against sudden differential thermal

stresses, thereby minimising the risks of micro-crack fracture through the body portion due to thermo mechanical stresses during pre-hat and at the start of the casting operation.

Advantageously, the material selected for use in the interface zone is structurally solid at temperatures up to about 700°C and becomes deformable without any appreciable chemical degradation at temperatures above about 700°C. Preferably the material providing the interface zone comprises a pyroplastic ceramic material.

Preferably, the interface zone comprises a ceramic material such as a paste or bonding agent or additional structural ceramic element exhibiting the aforesaid properties.

Conveniently, the pyroplastic material is a frittable composition applied over at least one of the co-operating assembly surfaces of the pouring tube element and the ceramic support element.

The ceramic support element is normally fully encapsulated within the metallic can, and fits with and around the upper part of the pouring tube element by virtue of said ceramic support element having an internal profile corresponding sufficiently to the external profile of the pouring tube. Conveniently, the respective profiles are such as to provide corresponding interference fit surfaces or otherwise matching, e.g. tapering surfaces to facilitate assembly, and in-fill or insertion of the required shock-absorbing interface zone material.

The ceramic support element may be pre-formed from a ceramic material of low thermal conductivity, or formed *in situ* by a suitable casting operation of a type familiar to those in this art.

The refractory device may be otherwise finished as is known in the art to suit its intended purpose, e.g. with regard to provision of flat surfaces and outlet nozzles etc.

Embodiments of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a cross-sectional view of a two-part plate and tube configuration in accordance with prior art;

Figure 2 is a cross-sectional view of a prior art monotube configuration;

Figure 3 is a cross-sectional view of a monotube configuration showing a stress micro-crack fracture of the type minimised by the present invention;

Figure 4 is a section of modified version of monotube assembly as per US 5 866 022.

Figure 5 is a diagram showing crack mark observed during service trials of such a configuration.

Figure 6 is a cross-sectional view of a refractory device according to one aspect of the present invention; and

Figure 7 is a cross-sectional view of a refractory device according to a second aspect of the present invention.

Referring now to the figures, there is shown in Figures 1-3 cross-sectional views of prior art refractory devices including the two-part plate and tube assembly known generally in the prior art and the early monotube configuration discussed above.

Figure 6 is a cross-sectional view of a refractory product according to one aspect of the present invention. This shows a refractory pouring device having a ceramic pouring tube element **10** such as for example of a pouring nozzle or sub entry shroud. The pouring tube element is supported in a metallic can **11**, which maintains the desired geometrical configuration of the tube for mechanical integrity of the pouring mechanism. A low thermal conductivity ceramic support element **12** is encapsulated within the metallic

can, and fits with and around the upper part of the pouring tube element, by virtue of said ceramic support element having an internal profile corresponding sufficiently to the external profile of the pouring tube. Here, a stepped shoulder, interference fit arrangement is illustrated.

The low thermal conductivity of the ceramic support element reduces heat losses from the pouring tube during metal teeming thereby minimising the differential thermal stresses experienced by the pouring tube which could lead to propagation of stress micro-crack features.

A shock absorbing interface zone **13** is formed between the low conductivity ceramic support element 12 and the pouring tube element 10. The zone is formed in accordance with one aspect of the invention by a layer of pyroplastic ceramic cement, the properties of which are chosen to provide optimum mechanical strength in temperatures below about 700°C to support the pouring tube during preheating operations and manipulation. The cement has a degree of pyroplasticity at elevated temperatures encountered during use of the pouring tube in the metal teeming process to absorb any residual differential stresses, which may be created during this process.

By way of example, the pyroplastic ceramic cement may be formed from an alumina-silicate mixture with an addition of fluxing agents to generate the pyroplastic behaviour. A typical analysis of said pyroplastic cement being alumina 20%, silica 54%, potassium oxide 6%, boric oxide 12% and sodium oxide 8%. Such a composition will provide for progressive melting from about 700°C to impart plasticity to the layer.

Figure 7 illustrates a further embodiment of the present invention wherein the pouring tube element **20** is coated with a pyroplastic surface layer **24** on its upper region to provide the desired low temperature rigidity and high temperature malleability. The coated tube is then encapsulated within the metallic can by a ceramic concrete **22**, which provides mechanical support to the pouring tube during the teeming process. Furthermore, the ceramic support element reduces heat losses from the pouring tube during metal teeming thereby minimising the differential thermal stresses experienced by the pouring tube which lead to propagation of stress micro-crack features.

In use of either of the refractory device described above, the pouring tube is mounted beneath the orifice of a vessel (not shown). Molten metal is poured through the pouring tube for example into a water-cooled mould (not shown). During the metal casting process, the external temperature of the pouring tube rises typically to between 700°C and 900°C. At temperatures up

to about 700°C, the pyroplastic interface zone (13; 24) between the pouring tube element (10; 20) and the ceramic element (12; 22) encapsulated in the metallic can remains solid and provides structural continuity and additional mechanical support to the pouring tube. Thereby, structural integrity of the refractory device is provided for e.g. during handling for transport purposes, and initially during assembly into a pouring mechanism and pre-heat. At temperatures above about 700°C however, at which differential thermal stresses between the pouring tube and the support therefor in the metallic can would have previously possibly caused a stress micro-crack fracture of the pouring tube, the pyroplastic interface zone becomes deformable, thereby minimising differential thermal stresses experienced by the pouring tube in the region supported by the metallic can. Therefore, in this way the possibility of micro-crack fracture through the refractory device and failure thereof is obviated or mitigated. Thus, the present invention results in an improved refractory device that has better reliability and is less prone to damage from differential stress micro-crack features.

Improvements in or relating to refractory products

This invention relates to improvements in or relating to refractory products and, more particularly, to improvements in refractory products used in the handling of molten metals to increase reliability under high temperature operating conditions.

Metal teeming, and in particular the casting of steel usually begins with the metal being melted and transferred to a vessel, e.g, a ladle or tundish. Refractory devices are required, amongst other things, for the regulation of the flow of the molten metal exiting from a nozzle mounted in the bottom of the vessel. In the casting of steel, this is typically applied through an opening in the base of the vessel via nozzles and shrouds into a water-cooled mould. Refractory devices such as sub-entry shrouds and pouring nozzles are often at least partly submerged for long periods of time in the molten metal during the metal teeming process and are therefore subject to high temperatures and stresses during the effective lifetime of the device.

In a typical teeming process, metal is melted in a furnace, transferred first to a ladle and then to a tundish from which it flows in a controlled manner into a cooled mould. A flow control valve is provided in the tundish comprising a flow control stopper rod selectively engageable with an outlet nozzle seat. The stopper would normally be raised off the seat by a certain amount to achieve a particular rate of flow of molten metal through the valve to ultimately cast a product in a mould.

The teeming apparatus would usually include a pouring nozzle or a shroud located beneath the flow control valve either of which may be immersed in melt as the casting operation proceeds.

In an exchange nozzle casting mechanism, the exchange pouring nozzle or shroud is supported beneath a stopper upper nozzle and stationary plate assembly which is used for sealing off the flow of molten metal above the pouring nozzle or shroud to allow the pouring nozzle or shroud to be changed during the teeming process.

of said ceramic support 12 element having an internal profile corresponding sufficiently to the external profile of the pouring tube.

7. A refractory device according to claim 6, wherein the respective profiles are such as to provide corresponding interferences fits surfaces or otherwise matching.

8. A refractory device according to any one of the preceding claims, wherein the ceramic support element 12 is pre-formed from a ceramic material of low thermal conductivity, or formed *in situ* by a suitable casting operation.

9. A refractory device according to any one of the preceding claims, wherein the refractory device is finished to suit its intended purpose.

AMENDED SHEET

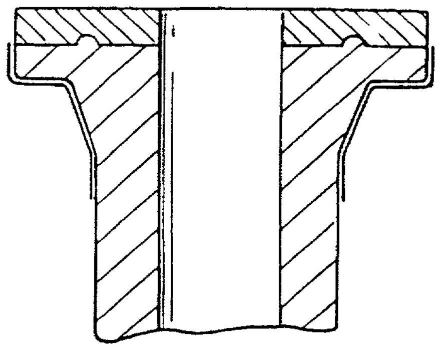

Fig. 1 **(PRIOR ART)**

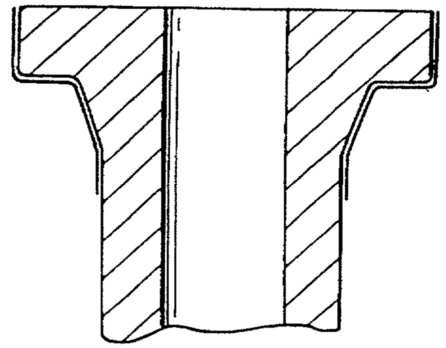

Fig. 2 **(PRIOR ART)**

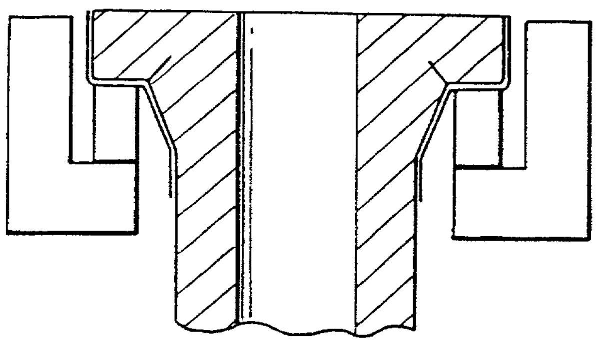

Fig. 3 **(PRIOR ART)**

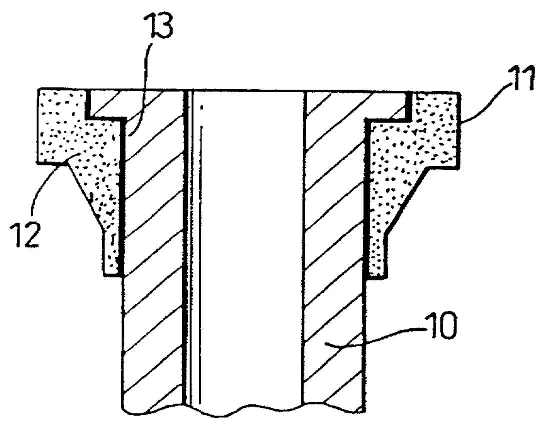

Fig. 6

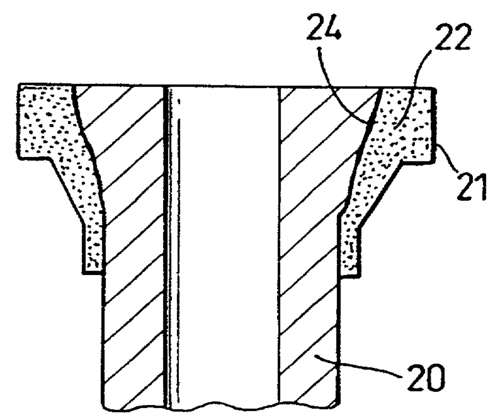

Fig. 7

SCALE 1:5

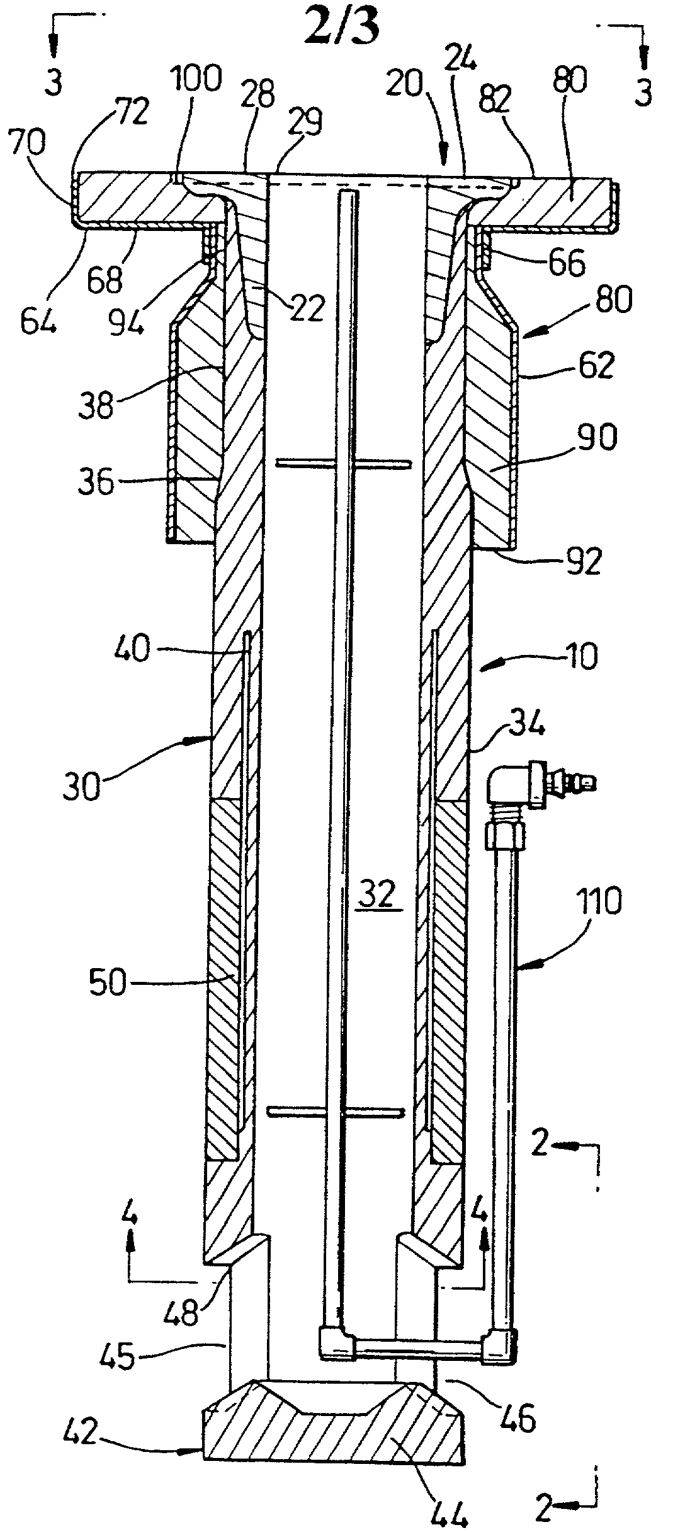
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Fig. 4

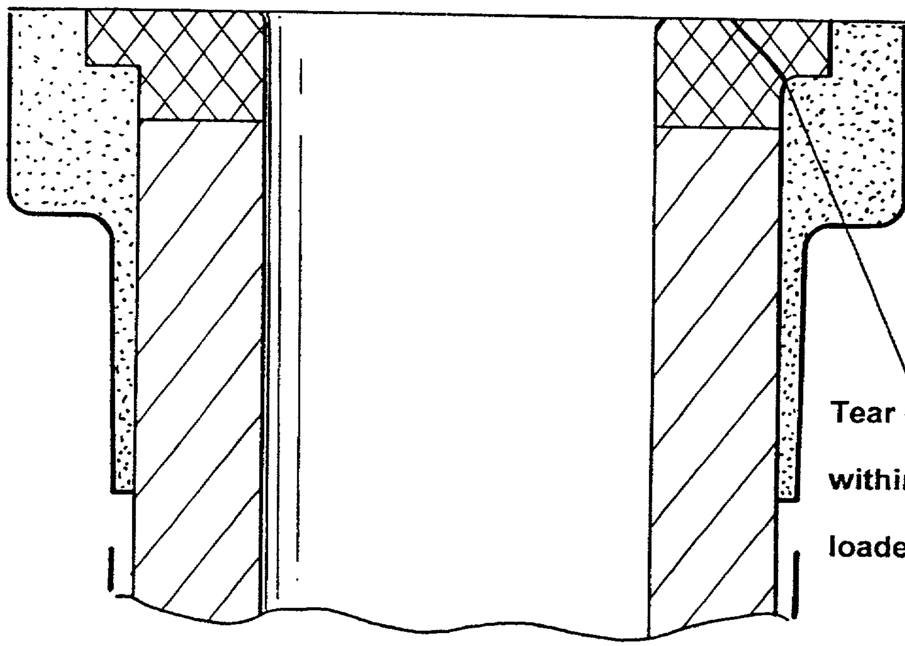

Fig. 5

Crack propagation
in MT-1597

Practitioner's Docket No. BE7344PCT(US) *PATENT*

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: *(check one applicable item below)*

[X] original.
[ ] design.
[ ] supplemental.
[ ] national stage of PCT.

INVENTORSHIP IDENTIFICATION

WARNING: *If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.*

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

IMPROVEMENTS IN OR RELATING TO REFRACTORY PRODUCTS

SPECIFICATION IDENTIFICATION

The specification of which: *(complete (a), (b), or (c))*

(a) [ ] is attached hereto.

NOTE: *"The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. § 1.63:*

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed; or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) [ ] was filed on ________________, as [ ] Application No. 0 / ________________ or [ ] ________________ and was amended on ____________________ *(if applicable).*

NOTE: *Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. § 1.67.*

NOTE: *"The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. § 1.63:*

"(1) name of inventor(s), and application number (consisting of the series code and the serial number; e.g.,08/123,456);

"(2) name of inventor(s), serial number and filing date;

"(3) name of inventor(s) and attorney docket number which was on the specification as filed;

"(4) name of inventor(s), title which was on the specification as filed and filing date;

"(5) name of inventor(s), title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(6) name of inventor(s), title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number; e.g.,08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

Notice of July 13, 1995 (1177 O.G. 60), M.P.E.P. § 601(a), 6th ed., rev.3.

(c) [X] was described and claimed in PCT International Application No. PCT/EP99/09194 filed on November 26, 1999 and as amended under PCT Article ~~19~~ 34 on August 25, 2000 *(if any).*

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56, and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

(also check the following items, if desired)

[ ] in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. § 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

NOTE: *"The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. § 119(b) must be filed in the case of an interference (§ 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in § 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. § 1.55(a).*

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) [ ] no such applications have been filed.
(e) [x] such applications have been filed as follows.

NOTE: *Where item (c) is entered above and the International Application which designated the U.S itself claimed priority check item (e), enter the details below and make the priority claim.*

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING DAY, **MONTH**, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
Great Britain	9825986.4	27 November 1998	[x]YES [ ]NO
			[ ]YES [ ]NO
			[ ]YES [ ]NO
			[ ]YES [ ]NO
			[ ]YES [ ]NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER	FILING DATE
_______ / ______________________	____________
_______ / ______________________	____________
_______ / ______________________	____________

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Mark Kusner Registration No. 31,115 i

I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other document.

NOTE: Each inventor must be identified by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and by his/her residence, post office address and country of citizenship. 37 C.F.R. § 1.63(a)(3).

NOTE: Inventors may execute separate declarations/oaths provided each declaration/oath sets forth all the inventors. Section 1.63(a)(3) requires that a declaration/oath, inter alia, identify each inventor and prohibits the execution of separate declarations/oaths which each sets forth only the name of the executing inventor. 62 Fed. Reg. 53,131, 53,142, October 10, 1997,

Full name of sole or first inventor

Stephen	John	Lee
(Given Name)	*(Middle Initial or Name)*	*Family (Or Last Name)*

Inventor's signature S. J. Lee

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______